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EFFECTS OF DEFOLIATION, PLANT MATURITY, AND GINNING SETUP ON COTTON QUALITY AND VALUE IN THE MIDSOUTH

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EFFECTS OF DEFOLIATION, PLANT MATURITY, AND GINNING SETUP ON COTTON QUALITY AND VALUE IN THE MIDSOUTH

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ABSTRACT

Results of a study conducted with 'DPL 16' cotton at Stoneville, Miss., in 1969-71 showed that twice-over harvesting usually gave higher yields and gross and net returns. Maximum returns to the farmer resulted when the first harvest occurred after 75 percent of the bolls were open. Defoliation improved grade but usually reduced yields, and this yield reduction plus costs of defoliation usually offset the advantage of improved grade. An elaborate ginning setup reduced fiber weight when compared with a normal setup and did not improve the fiber enough to offset the added costs of the setup and the loss in fiber weight.

INTRODUCTION

The quality and economic value of fiber produced from a cotton crop depend on many factors, of which preharvest plant preparation (defoliation), timing and method of harvesting, and ginning are just a few. Previous research has indicated that defoliation may or may not be beneficial to cotton farmers in the Midsouth and, that, in the future, twice-over harvesting and elaborate gin cleaning setups may prove too costly for use by cotton farmers. Each time a machine passes through a field of mature cotton, some damage occurs, namely the loss of either green bolls or open cotton. Excessive ginning

damages fibers, reducing the quality of the cotton. The cotton producer must decide each year whether or not to defoliate, whether and when to use once- or twice-over harvesting, and how much cleaning at the gin is necessary to produce a quality crop economically.

This study was designed to study the interactions among defoliation, level of plant maturity at harvest, and ginning setup in controlled tests. The objectives of this study were to determine (1) the optimum time for the first cotton harvest, (2) the optimum cleaning and ginning procedures to use, (3) whether or not to defoliate cotton, (4) the possible economic benefits of a second harvest, and (5) the interacting effects of defoliation, plant maturity at harvest, and ginning on the fiber properties and fiber quality of the cotton.

LITERATURE REVIEW

The effects of defoliation on the quality and quantity of the crop have been investigated by many researchers with varying results.

Tharp and others (12)⁵ found that defoliation has no bad influence on bolls which are open

⁵ Italic numbers in parentheses refer to items in "Literature Cited" at the end of this publication.

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or are fully mature but not yet open at the time of application of the defoliant. They found that any bolls less than 36 days old at the time of defoliation may suffer loss in weight of fiber and seed and in quality of eventual products.

Porter and others (9) indicated that some of the advantages resulting from defoliation are higher harvesting efficiency, increased picking time per day, retardation of crop deterioration, reduction of insect population in the crop, and reduction of lint stain and trash content. They also gave some general tips concerning the application of a defoliant.

Thomas and Williamson (13) found that early and intermediate defoliation appeared to lower the fiber as judged by length, strength, Micronaire, and similar measurements and quantity of the crop harvested by the picker. Defoliation also tended to improve grade.

Riley and Williamson (10) compared weather parameters in defoliated and untreated fields. They discovered that the relative humidity remained at less than 50 percent for about an hour longer after sunrise in a defoliated field; these measurements indicate that defoliated cotton-fields are drier in the daytime during the time of picking. They also found that the maximum temperature before frost averaged almost 5° F higher in the defoliated field and the minimum temperature 1° F lower.

Jones (6) showed that green leaves in a picked sample from untreated cotton caused heating and spotted lint turnout and increased the moisture content of the seed-cotton sample. Defoliation removes all green leaves.

Williamson and Riley (14) reported that yield decreased when mechanical picking was delayed until after frost. Slightly higher grades resulted from defoliating and picking before frost. Defoliation decreased lint moisture, foreign-matter content of seed cotton, and boll maturity. Picking efficiency dropped and total seed-cotton loss increased as time of picking was delayed. Grade improvements resulting from defoliation decreased from early-season harvest to harvest near the time of the first frost. These workers concluded that defoliants must be applied on a date that will balance the quality of an early harvest with the quantity of a late harvest and that the pickers must operate during the hours of optimum seed-cotton moisture content in order to minimize staining.

Parker and Wooten (8) studied the relationships among defoliation, seed-cotton moisture, and storage. They found that the seed cotton harvested from untreated plants had a higher foreign-matter content and a higher moisture content than that harvested from defoliated plants. Moisture from the foreign matter in stored seed cotton transfers either into the seed and lint or into the atmosphere, depending on the depth of the mass of seed cotton. Cotton quality deteriorates when a mass of seed cotton is stored at a high moisture content. They also found that defoliation adversely affects fiber length and strength, and fiber color value tends to vary inversely with seed-cotton moisture at the time of harvest.

McMeans, Walhood, and Carter (7) found that defoliation reduced yield but had little or no effect on trash or moisture content or on fiber properties. The defoliant was applied when 70 percent of the bolls were open. Desiccation with 85 percent of the bolls open was not significantly different from that naturally occurring in the untreated cotton.

Crowe and Carnes (4), in evaluating the economics of defoliation in a study from 1954 to 1956, found that defoliation would pay if applied to rank, heavily fruited cotton that has matured when there was adequate moisture. They stated that defoliation does not pay, however, if applied to small, drought-stressed, heavily fruited plants from which a larger percentage of the leaves have fallen from natural causes. Crowe and Carnes found no detrimental effects on fiber properties from defoliation when properly carried out.

Barker and Thomas (2) reported that there were no significant differences in harvest yields, composite grades, staple lengths, reflectance, upper-half mean lengths, and Micronaire in a study comparing normal defoliation and harvesting procedures with bottom defoliation and bottom harvesting. Overall, the conventional method of defoliation followed by twice-over harvesting gave the highest gross returns.

Barker and others (1) carried out an extensive study including once-over and twice-over harvesting using two different harvesters. Cotton used in this test underwent several different preparations for harvest. Some was untreated, some received early or regular bottom defoliation, and the rest was totally defoliated in early and late treatments. In studying the results, the

researchers found that each year must be considered separately. Once-over harvesting can result in higher, lower, or the same yields as conventional harvesting, depending upon the individual year. They also showed that defoliation tended to reduce yield, gross returns, and length and strength of fibers, but increased grade. Defoliation also reduced moisture, trash, and the incidence of spotted lint in the cotton fiber.

Stapleton, Cannon, and LePori (11) developed a method for determining the optimum schedule for defoliating and harvesting cotton in Arizona. They showed that defoliating when the field was 50-percent open and harvesting prior to 25 days after the field was 50-percent open followed by a second harvest produced the largest amount of harvested cotton. Quality of the cotton decreased with time.

Garner, Thomas, and Dickson (5) worked with the environmental history of the crop to try to obtain a prediction factor to assist in the scheduling of cotton defoliation and harvest. They found that growing degree days (base of 60° F) were sufficiently correlated with percentage of open bolls to give a good prediction of maturity within a single year, but when different years were considered, the number of days after planting was just as good an indicator. They also found that differences in defoliation dates in fields with 40-percent-open and 90-percent-open cotton caused no significant differences in yield, quality, or harvesting efficiency.

RESEARCH METHODS

Each year, a field of 'DPL 16' cotton was divided into five blocks (replicates). Each replicate was divided into six plots. One plot from each replicate was first-over harvested at a certain level of plant maturity, giving a total of six plots harvested for each level of maturity. Half of each of these plots was defoliated approximately 1 week before harvest while the other half was not. The cotton from each half plot was divided at the gin and subjected to two different ginning setups. The following schedule of harvesting was used each year for 3 years, if the weather permitted.

Harvesting procedures (with conventional two-row cotton picker):

Plot 1. First picking when field was approximately 40-percent open.

Plot 2. First picking 1 week after field was 40-percent open.

Plot 3. First picking 2 weeks after field was 40-percent open.

Plot 4. First picking 3 weeks after field was 40-percent open.

Plot 5. First picking 4 weeks after field was 40-percent open.

Plot 6. First picking when 100 percent of the field was open.

Plots 1-5 were second-picked when 100 percent of the remaining cotton bolls were open. Number of open bolls was determined by an actual field count of open bolls in 10 feet of row at 10 random spots in the field prior to harvest.

Defoliation:

Half of each plot was defoliated at least 1 week prior to picking.

Ginning setups:

1. Normal setup: drier, six-cylinder cleaner, stick remover, six-cylinder cleaner, extractor-feeder-cleaner, and two lint cleaners.

2. Elaborate setup: drier, six-cylinder cleaner, stick remover, six-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and three lint cleaners.

The following data were obtained.

1. Harvesting data:

- (a) Yield, picking efficiency.
- (b) Quality factors—length, strength, Micronaire reading.
- (c) Date of first boll opening.
- (d) Date of each picking.
- (e) Any changes made in picking practices.

2. Ginning data:

- (a) Ginning date.
- (b) Staple length.
- (c) Grades.
- (d) Seed quality.
- (e) Moisture content of seed cotton.
- (f) Trash content of seed cotton.
- (g) Foreign-matter content of lint.

3. Weather data:

- (a) Net radiation.
- (b) Temperature at ground level, 5 feet above, etc.
- (c) Rainfall.
- (d) Humidity.

4. Economic data:

- (a) Value of crop
- (b) Cost of defoliation, harvesting, and ginning.
- (c) Net returns per acre.

Fiber tests and analyses for the 3-year study

were performed at Agricultural Research Service's (ARS) Cotton Quality Research Station, Clemson, S.C. In 1960, additional fiber and miniature spinning tests were carried out at the ARS Quality Cotton Laboratory, Knoxville, Tenn. Results from these special tests are presented in table 15. The tests from the two different locations gave slightly different results.

EXPERIMENT AND RESULTS, 1969

Dates of first pickings for the six test plots in 1969 were September 15, September 22, September 29, October 6, October 14, and November 5. All bolls were open in the November 5 picking, and at that time the other plots were second-picked. The harvester used was a John Deere 99, two-row, high-drum cotton picker equipped with a special plot-picking attachment.

Figure 1 shows the boll-opening curve for the 'DPL 16' cotton grown in this study. The moisture content of the seed-cotton samples was definitely related to plant maturity and defoliation. Figure 2 shows samples of the untreated and defoliated cotton harvested at various stages of maturity. The untreated cotton harvested on September 15 when 40 percent of the bolls were open was high in green-leaf content, and wagon-sample moisture ran as high as 24.9 percent. The 60-percent-open cotton harvested a week later contained up to 15.6 percent moisture, and the 75-percent-open untreated cotton harvested September 29 was a damp 14.3 percent. However, when the cotton was 90-percent open on October 6, moisture content was 10.5 percent or below, and the cotton was dry enough for good handling at the gin (table 1). Moisture content rose slight-

ly before the next harvest, then dropped when all bolls were open.

The weather was favorable through most of the test period, and only the first picking, scheduled for October 13, was postponed until October 14 because of rain (table 2). Relative humidity and temperature decreased as the season progressed. There was a marked drop in temperature after October 14.

Yield was lower than expected because of extended dry periods during the growing season, even though the cotton was irrigated twice.

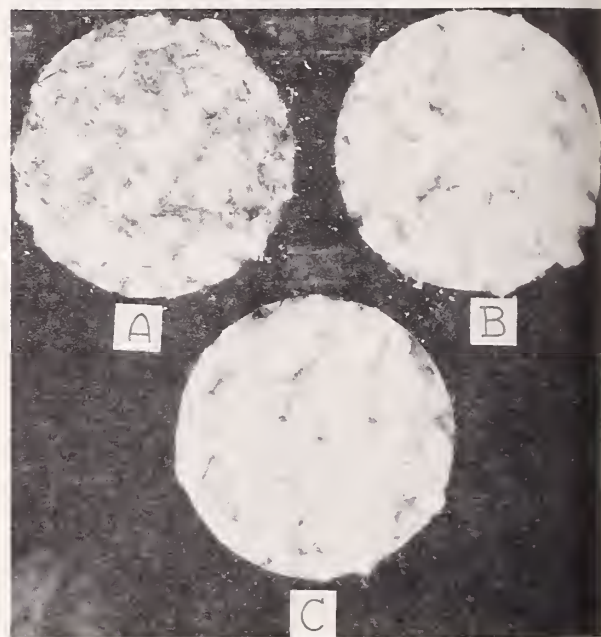


FIGURE 2.—Wagon samples of untreated (A) and defoliated (B) cotton from 40-percent-open plot and defoliated cotton (C) from 100-percent-open plot.

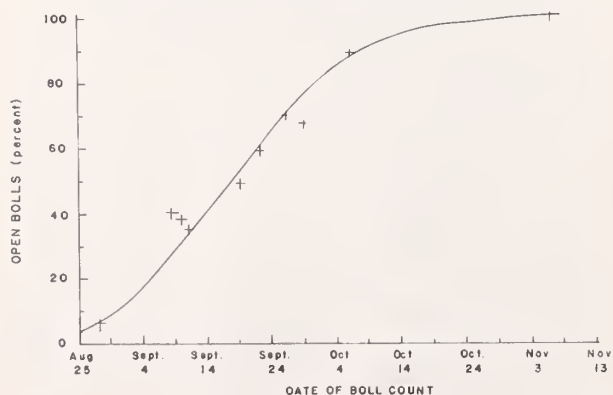


FIGURE 1.—Boll-opening curve for 'DPL 16' cotton, 1969.

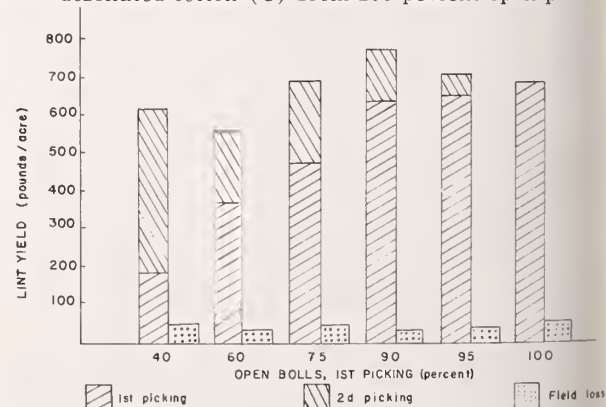


FIGURE 3.—Lint cotton yields from pickings at various percentages of open bolls and corresponding field losses. Yield values are averages for defoliated and untreated parts of individual plots.

TABLE 1.—*Cotton moisture data, 1969¹*

Date of 1st harvest ² and defoliated (D) or untreated (U)	Ginning setup ³	Percentage of moisture in—							
		Wagon sample		Feeder sample		Lint		Seed	
		1st picking	2d picking	1st picking	2d picking	1st picking	2d picking	1st picking	2d picking
Sept. 15, 40-pct open:									
D	Normal	11.9	8.7	9.5	8.1	7.3	7.0	10.6	9.8
D	Elaborate	12.8	8.9	10.0	7.4	6.5	5.4	12.7	9.1
U	Normal	24.9	8.8	19.9	7.7	10.7	6.7	15.0	9.9
U	Elaborate	28.6	9.4	19.1	7.8	7.7	5.8	14.1	9.3
Sept. 22, 60-pct open:									
D	Normal	12.3	8.6	11.6	7.6	7.0	4.8	12.9	8.8
D	Elaborate	12.8	10.0	10.6	7.9	8.5	5.4	13.3	9.9
U	Normal	13.4	9.2	12.9	8.0	7.0	5.3	13.4	9.9
U	Elaborate	15.6	10.6	12.3	8.5	7.6	5.8	13.4	10.4
Sept. 29, 75-pct open:									
D	Normal	8.4	9.3	6.8	8.2	3.6	5.3	8.8	10.3
D	Elaborate	8.3	8.7	6.9	8.4	3.3	4.7	7.5	8.8
U	Normal	14.0	8.7	8.1	7.6	3.6	4.8	9.4	9.6
U	Elaborate	14.3	10.5	8.6	7.5	3.3	4.5	8.9	9.5
Oct. 6, 90-pct open:									
D	Normal	9.2	9.2	9.1	7.8	8.5	4.3	8.7	9.3
D	Elaborate	8.7	8.6	8.7	7.4	8.2	3.0	9.3	9.5
U	Normal	10.5	8.6	10.0	7.4	8.5	3.2	10.5	9.8
U	Elaborate	10.5	8.4	10.2	7.5	8.0	3.3	10.7	8.9
Oct. 14, 95-pct open:									
D	Normal	11.2	8.3	9.8	7.2	5.3	3.5	12.3	9.4
D	Elaborate	11.6	9.0	8.9	7.8	5.1	3.5	10.7	9.0
U	Normal	13.2	9.1	10.3	7.2	5.0	3.7	12.1	9.3
U	Elaborate	13.1	10.4	9.7	8.2	5.0	3.9	11.4	8.9
Nov. 5, 100-pct open:									
D	Normal	8.9	...	7.2	...	4.5	...	8.7	...
D	Elaborate	8.0	...	7.5	...	4.4	...	9.7	...
U	Normal	9.2	...	7.3	...	4.5	...	9.3	...
U	Elaborate	9.6	...	8.4	...	4.7	...	10.2	...

¹ Values are averaged over 5 samples, 1 from each of 5 replicates.

² Second picking was done when the remaining cotton was 100-percent open.

³ Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

There was a significant interaction in 1969 between plant preparation and maturity as shown by the effects of harvest timing and defoliation on lint yields, gross returns, and net returns per acre (tables 3 and 4, fig. 3). The harvests made when the cotton was 90- to 95-percent open were superior to the other harvests in total lint yield, gross returns, and returns above operating costs. The operating costs, which include defoliation and harvesting costs, are

shown in table 5. The untreated cotton was significantly better than the defoliated cotton in total lint yield, gross returns, and returns above operating costs.

Significant differences occurred among different harvesting dates for the fibrograph length, length uniformity index, staple length, and grade index (table 6). Fibrograph length and staple length decreased with the later harvesting dates. The length uniformity index was

TABLE 2.—*Weather preceding harvest, 1969*¹

Weather parameters	Aug. 16– Sept. 15	Sept. 16– Sept. 22	Sept. 23– Sept. 29	Sept. 30– Oct. 6	Oct. 6– Oct. 14	Oct. 15– Nov. 6
Days	31	7	7	7	8	24
Total rainfall inches ..	2.40	0	0	0	0.70	0.81
Growing degree days base 60° F ..	540	109	77	86	89	30
Accumulative degree days ... base 60° F ..	540	649	726	816	901	931
8-hour periods of 95-pct relative humidity	41	11	6	6	10	5
Solar radiation ... langleys ..	13,479	2,485	3,236	3,124	2,528	7,300
Energy degree units $\times 10^{-4}$	728	27	25	27	22	22
Hours < 60° F	32	0	28	19	57	323

¹ Energy degree units = (Mean temperature minus the base temperature) times the daily accumulation of solar radiation in langleys per day.

TABLE 3.—*Effects of different stages of plant maturity on lint yields and dollar returns, 1969*¹

Date of 1st harvest	Open bolls (pct)	Lint yield, 1st picking (lb/acre)	Total lint yield (lb/acre)	Gross returns (dol/acre)	Return above operating costs ² (dol/acre)
Sept. 15	40	184.5	614.9c	131.22c	114.44d
Sept. 22	60	367.1	564.4d	122.14c	105.36d
Sept. 29	75	466.8	684.2d	145.79b	129.01c
Oct. 6	90	638.1	762.9a	174.59a	157.81a
Oct. 14	95	644.4	703.4b	164.49a	147.71ab
Nov. 5	100	680.9	680.9b	149.34b	139.32bc

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples for each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² Include costs of defoliation and harvesting.

significantly higher in the plots which were first harvested when the cotton was 60-percent-open or 90-percent-open. The plots picked when the cotton was 90- to 95-percent-open were significantly higher in grade index than the plots picked during the other periods. The early-harvested, untreated, 40-percent-open and 60-percent-open cotton suffered grade penalties due to spotting from leaf stain. There were no significant interactions for length, length uniformity, staple length, or grade index. Defoliation and ginning significantly affected grade index but did not significantly affect the length characteristics or Micronaire.

Significant differences also occurred among harvesting dates for the colorimeter, micronaire,

and strength data (table 6). The first and last cotton had significantly reduced colorimeter reflectance and degree of yellowness. The earliest cotton had a significantly lower micronaire value than did cotton from the other harvesting dates. Strength was significantly increased by harvesting when the cotton was 60- and 95-percent-open.

There were no significant differences in fiber strength between the cotton picked when 90-percent open and the cotton picked on the middle three harvesting dates.

Defoliation resulted in significantly higher colorimeter reflectance and composite grade and a significantly lower degree of yellowness (table 7).

The elaborate ginning setup resulted in signifi-

TABLE 4.—*Effects of defoliation on lint yields and dollar returns, 1969–71*¹

Year and defoliated or untreated	Lint yield, 1st picking (lb/acre)	Total lint yield (lb/acre)	Gross return (dol/acre)	Return above operating costs ² (dol/acre)
1969:				
Defoliated	490a	647b	144.81b	128.19b
Untreated	504a	690a	151.05a	136.36a
1970:				
Defoliated	812a	980b	229.11b	213.05b
Untreated	839a	1,040a	244.23a	230.10a
1971:				
Defoliated	652a	733a	160.86a	144.11a
Untreated	655a	765a	167.04a	152.23a

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation, using 12 samples from each of 5 replicates for 1969 and 1971 and 8 samples for each of 5 replicates for 1970. Values in the same column and from the same year followed by the same letter are not significantly different at the 95-percent level according to the *F*-test.

² Include costs of defoliation and harvesting.

TABLE 5.—*Defoliation and harvesting costs, 1969–71*

Operation	Costs/acre		
	Direct ¹	Labor	Total
Defoliation	\$1.78	\$0.15	\$1.93
First harvest (all plots)	7.81	1.25	9.06
Second harvest (all plots)	5.83	.93	6.76
Twice-over harvests (untreated) plots)			15.82
Twice-over harvests (defoliated plots)			17.75
Once-over harvest (untreated plots)			9.06
Once-over harvest (defoliated plots)			10.99

¹ Include only costs of fuel and repairs on machinery. Source: 3.

cantly higher colorimeter reflectance and composite grade. It also significantly reduced foreign matter in the lint and the fiber strength when compared with the normal ginning setup (table 8).

Delaying the harvest until the cotton was at least 90-percent open significantly reduced large-leaf and small-leaf trash in the wagon sample, as well as tending to reduce total foreign matter in the wagon sample (table 9). This is probably because natural leaf abscission had decreased foreign matter on the plants by this time.

The defoliated cotton had significantly lower amounts of large-leaf and small-leaf trash and less total foreign matter in the wagon sample

than did the untreated cotton (table 10). As the harvesting season progressed, the amount of foreign matter left in the sample at the feeder apron decreased significantly. Leaf content was the primary fraction affected. Defoliation also significantly reduced the foreign matter recorded at the feeder apron. The primary fractions affected by defoliation were large-leaf and small-leaf material and sticks and stems. The amount of foreign matter in the lint tended to be higher for the untreated cotton in the early harvests and tended to be lower for this cotton in the later harvests (table 11).

Fiber strength and length uniformity tests were performed on representative samples for the entire study, but the data failed to show any important differences. Likewise, fiber and miniature spinning tests were performed on representative samples for the entire study (table 12). These latter tests showed a stronger yarn skein strength of 114 to 120 pounds for the early damp cotton. However, by the time the cotton had dried out in the field and reached the 90-percent-open stage, a more desirable stage for harvesting, handling, and ginning (3 weeks after the cotton was 40-percent open), the yarn skein strength had leveled off at 110 to 114 pounds. This is a good yarn skein strength and is better than the 106- to 97-pound skein strength associated with the really dry 95- to 100-percent-open stages of harvesting. The fiber length, length uniformity index, yarn skein strength, and

TABLE 6.—*Effects of different stages of plant maturity on fiber quality, 1969-71¹*

Date of 1st harvest	Open bolls (pct)	Colorimeter reflectance	+ b	Micronaire	Strength, 0-gage (1,000 lb/ inch ²)	Fibro- graph length (inch)	Length uniformity index (pct)	Staple length (320s of an inch)	Grade ²
1969									
Sept. 15	40	72.5c	8.2b	4.4b	82.8b	1.13ab	45.5b	34.6a	92b
Sept. 22	60	74.0b	8.7a	4.7a	85.5a	1.14a	46.8a	34.4b	93b
Sept. 29	75	73.2bc	8.8a	4.7a	82.0b	1.12abc	45.8b	34.0c	94b
Oct. 6	90	75.6a	8.8a	4.8a	84.4ab	1.13ab	47.0a	34.0c	98a
Oct. 14	95	75.5a	8.5ab	4.8a	85.9a	1.11bc	45.8b	34.0c	99a
Nov. 5	100	72.9bc	7.7c	4.8a	82.1b	1.10c	44.9b	34.0c	94b
1970									
Sept. 21	40	76.1b	8.4b	4.2a	80.3c	1.15a	44.0a	34.9a	96b
Sept. 28	60	76.2b	8.4b	4.2a	81.8a	1.14b	44.6b	34.8a	98a
Oct. 5	75	77.2a	8.3b	4.1a	81.3ab	1.14b	44.5b	35.0a	99a
Nov. 5	100	74.7c	7.6a	4.2a	80.8bc	1.14b	43.6c	34.5b	96b
1971									
Sept. 28	76	76.1bc	7.8a	3.7a	80.6a	1.16a	44.8a	35.2a	97c
Oct. 5	87	76.5abc	7.8a	3.7a	80.4a	1.16a	43.9b	34.7bc	99ab
Oct. 12	92	76.7ab	8.0a	3.8a	81.2a	1.14c	43.7bc	34.8b	99ab
Oct. 19	95	75.7c	7.8a	3.8a	80.2a	1.15b	44.3ab	34.6bc	98bc
Oct. 26	98	76.1bc	7.7a	3.9a	78.7b	1.15b	43.8bc	34.5bc	98bc
Nov. 8	100	77.2a	7.4b	4.0a	79.0b	1.13d	43.3c	34.4c	100a

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 8 samples from each of 5 replicates. Values in the same column from the same year followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² 100 = Middling, 94 = Strict Low Middling, 90 = Low Middling Plus.

TABLE 7.—*Effects of defoliation on fiber color and grade, 1969¹*

Defoliated or untreated	Colorimeter reflectance	+ b	Composite grade ²
Defoliated	74.3	8.4	95.6
Untreated	73.6	8.5	94.4

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation, using 12 samples from each of 5 replicates. Values in the columns are significantly different at the 95-percent level according to the *F*-test.

² 100=Middling; 94=Strict Low Middling.

Micronaire value all ranked high in the 90-percent-open stage, as compared to the other harvesting stages.

Five one-row plots, one in each replicate, were picked by hand each time the other plots were machine-picked, for a total of six times each, and yield and fiber data for each of these harvests are shown in table 13. The cotton picked early in the season tended to have a higher Micronaire value and a lower nep count and tended to be shorter.

The data obtained immediately after harvesting shows very high cottonseed moisture for the early-picked, untreated plots. This probably explains the high incidence of cracked seeds and low germination percentages for these plots (table 14). The germination percentage tended to increase as the first harvest was delayed. The number of light seeds tended to be higher for the defoliated cotton than for the untreated cotton.

Data on moisture content, germination percentages, and cracked and light seeds in the cotton picked in the second harvests are shown in table 15.

CONCLUSIONS, 1969

Highest yields and highest returns above preparation and harvesting costs resulted from conventional twice-over harvesting of untreated cotton. Results of the test indicate that first harvest should occur when 85 to 95 percent of the bolls are open. Although cotton from earlier harvests had longer fibers, the decrease in grade resulting from moisture and green leaves in the cotton offset this advantage. The field loss and losses in quality resulting from the delayed once-over harvest when 100 percent of the bolls were open were enough to offset the lower costs of a single harvest.

An elaborate ginning setup which included an additional impact cleaner and lint cleaner improved grade but reduced fiber strength, lint turnout, and trash content of the lint. Defoliation tended to increase grades but reduced yield enough to make it more profitable to leave the crop untreated.

EXPERIMENT AND RESULTS, 1970

During the 1970 harvest season, adverse weather interrupted the harvesting schedule; 7.86 inches of rain fell between October 6 and November 5 (table 16) and prevented any harvest.

(Continued on page 12.)

TABLE 8.—*Effects of ginning setup on fiber quality and lint foreign matter, 1969¹*

Ginning setup ²	Colorimeter reflectance	Strength, 0-gage (1,000 lb/inch ²)	Lint foreign matter ³ (pct)	Composite grade ⁴
Normal	73.7	84.1	2.28	94.4
Elaborate	74.2	83.5	1.70	95.6

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 12 samples from each of 5 replicates. Values in the same column are significantly different at the 95-percent level according to the *F*-test.

² Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

³ Includes varying amounts of vines, grass, and motes.

⁴ 100=Middling; 94=Strict Low Middling.

TABLE 9.—*Effects of different stages of plant maturity on wagon- and feeder-sample foreign matter, 1969¹*

Date of 1st harvest	Open bolls (pct)	Foreign matter (pct)					Total ³
		Hulls	Sticks and stems	Large- leaf ²	Small- leaf ²	Pin trash	
Wagon-sample foreign matter:							
Sept. 15	40	1.48a	0.66a	2.14a	2.11a	0.20a	7.11a
Sept. 22	60	1.49a	.47a	1.58b	1.47b	.23a	6.12abc
Sept. 29	75	1.46a	.65a	1.33bc	1.99a	.18a	6.29ab
Oct. 6	90	1.43a	.56a	1.10cd	1.83a	.15a	5.46bc
Oct. 14	95	1.56a	.51a	1.00cd	1.50b	.19a	5.28bc
Nov. 5	100	1.66a	.47a	.87d	1.45b	.20a	5.08c
Feeder-sample foreign matter:							
Sept. 15	40	.47a	.49a	.82a	.39a	.07a	2.76a
Sept. 22	60	.36b	.34a	.43b	.27b	.06ab	1.87b
Sept. 29	75	.26b	.26a	.24c	.19c	.02ab	1.31c
Oct. 6	90	.30b	.28a	.13d	.26b	.00b	1.25c
Oct. 14	95	.26b	.25a	.07de	.22bc	.00b	1.20c
Nov. 5	100	.35b	.22a	.02e	.17c	.00b	1.05c

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replications. Values for feeder samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replicates. Values in the same column and from the same group of samples followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

³ Includes varying amounts of vines, grass, and motes.

TABLE 10.—*Effects of defoliation on foreign matter in wagon and feeder-apron samples, 1969¹*

[Percent]						
Defoliated or untreated	Hulls	Sticks and stems	Large- leaf ²	Small- leaf	Pin trash	Total ³
Wagon-sample foreign matter:						
Defoliated	1.63a	0.50a	0.78b	1.58b	0.18a	5.19b
Untreated	1.40b	.61a	1.89a	1.88a	.20a	6.59a
Feeder-apron sample foreign matter:						
Defoliated	.34a	.26b	.13b	.21b	.02a	1.30b
Untreated	.33a	.36a	.44a	.29a	.03a	1.85a

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity and defoliation, using 6 samples from each of 5 replicates. Values for feeder-apron samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation, using 12 samples from each of 5 replicates. Values in the same column and from the same group of samples followed by the same letter are not significantly different at the 95-percent level according to the *F*-test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

³ Includes varying amounts of vines, grass, and motes.

TABLE 11.—*Interaction of defoliation and plant maturity on lint foreign matter, 1969¹*

Defoliated or untreated	Foreign matter (pct) in cotton first picked on—					
	Sept. 15	Sept. 22	Sept. 29	Oct. 6	Oct. 14	Nov. 5
Defoliated	2.03bcd	1.85cde	1.69cde	2.08bc	2.12bc	1.65de
Untreated	2.90a	2.09bc	1.69cde	2.31b	1.83cde	1.59e

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation, using 2 samples from each of 5 replicates. Values followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

TABLE 12.—*Fiber and miniature spinning test data, 1969^{1 2}*

Property	Defoliated cotton		Untreated cotton	
	Normal ginning setup ³	Elaborate ginning setup ⁴	Normal ginning setup ³	Elaborate ginning setup ⁴
Sept. 15, 40-pct open:				
50% span length	inch	0.51	0.50	0.50
2.5% span length	inch	1.20	1.18	1.18
Uniformity index	pct	43	43	42
Yarn skein strength	lb	120	114	119
Coefficient of variation	pct	4.7	5.5	4.8
Micronaire reading		4.5	4.5	4.6
Sept. 22, 60-pct open:				
50% span length	inch	0.50	0.49	0.51
2.5% span length	inch	1.14	1.13	1.14
Uniformity index	pct	43	43	44
Yarn skein strength	lb	116	114	112
Coefficient of variation	pct	4.2	4.3	4.9
Micronaire reading		4.8	4.7	4.8
Sept. 29, 75-pct open:				
50% span length	inch	0.46	0.47	0.48
2.5% span length	inch	1.10	1.12	1.14
Uniformity index	pct	42	41	42
Yarn skein strength	lb	102	100	105
Coefficient of variation	pct	6.3	5.2	5.5
Micronaire reading		4.7	4.8	4.8
Oct. 6, 90-pct open:				
50% span length	inch	0.50	0.49	0.50
2.5% span length	inch	1.13	1.13	1.13
Uniformity index	pct	44	43	44
Yarn skein strength	lb	112	110	114
Coefficient of variation	pct	4.8	4.4	4.6
Micronaire reading		4.9	4.8	4.9
Oct. 14, 95-pct open:				
50% span length	inch	0.50	0.46	0.46
2.5% span length	inch	1.10	1.11	1.09
Uniformity index	pct	43	41	42
Yarn skein strength	lb	106	104	100
Coefficient of variation	pct	5.3	5.2	6.6
Micronaire reading		4.9	4.8	4.8
Nov. 5, 100-pct open:				
50% span length	inch	0.45	0.44	0.45
2.5% span length	inch	1.09	1.08	1.08
Uniformity index	pct	41	41	42

See footnotes at end of table.

TABLE 12.—*Fiber and miniature spinning test data, 1969*^{1 2}—Continued

Property	Defoliated cotton		Untreated cotton		
	Normal ginning setup ³	Elaborate ginning setup ⁴	Normal ginning setup ³	Elaborate ginning setup ⁴	
Nov. 5, 100-pct open—Continued:					
Yarn skein strength	lb	98	97	98	99
Coefficient of variation	pct	6.2	5.9	6.1	5.5
Micronaire reading		4.7	4.7	4.8	4.7

¹ Values are averaged over 5 samples, 1 from each of 5 replicates.

² Data in this table are from fiber and miniature tests performed in Knoxville, Tenn. All other fiber data in this study are from tests performed in Clemson, S.C.

³ Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners.

⁴ Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

vesting between these dates. First-over harvests in 1970 were on September 21, September 28, October 5, November 5, and November 24. The November 5 harvest occurred when 100 percent of the bolls were open, and second pickings on the other plots were on November 24.

Temperature decreased as the season progressed. Solar radiation measurements and degree days both show the effects of a very wet October (table 16).

The 'DPL 16' seed was planted on May 5, and by May 11, there was a very good stand. The test plots were irrigated on July 29. The first open bolls were observed August 17. The ginning and defoliation programs were the same as in 1969.

Figure 4 shows the boll-opening curve for the 'DPL 16' cotton grown in this study.

Wagon-sample moisture in the 40-percent-open untreated cotton harvested on September 21 was as high as 18.7 percent in individual plots with an average of 14.7 percent (table 17). The 60-percent-open cotton harvested a week later contained up to 15.1-percent moisture with an average of 11.9 percent. The cotton harvested when all bolls were open had more moisture than the cotton harvested when 75 percent of the bolls were open. This increase was a result of heavy rainfall during the period prior to last picking.

There were no significant interactions among harvest timing, defoliation, and ginning setups for lint yields, gross returns, and returns above operating costs. There were no significant differences in lint yields, gross returns, and re-

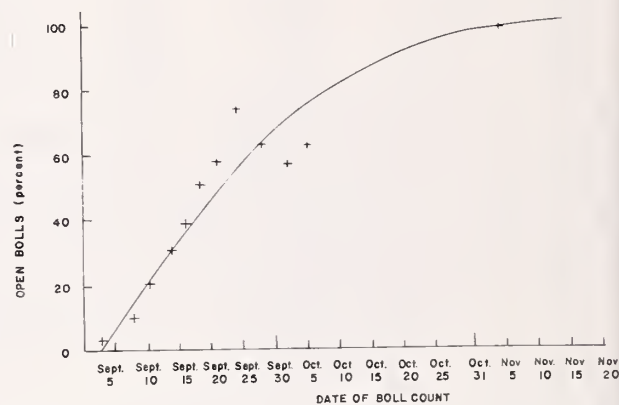


FIGURE 4.—Boll-opening curve for 'DPL 16' cotton, 1970.

turns above preparation costs among the different harvest times (table 18). The untreated cotton yielded significantly more cotton per acre and had higher gross returns and returns above defoliation and harvest costs than the defoliated cotton (table 4). The costs for each operation (the same as in 1969) are shown in table 5. Green stain in the early-harvested, untreated cotton caused some grade penalties, but not enough to significantly affect the dollars returned per acre.

There were no significant differences between the two ginning setups in lint yields, gross returns, and returns above operating costs.

Significant differences occurred among different harvesting dates for the fibrograph length, length uniformity, staple length, and grade index (table 6). Fibrograph length, staple length, and length uniformity index decreased with the later harvesting dates. The cotton picked during the 60- and 75-percent-open periods was

TABLE 13.—*Effects of handpicking cotton at different stages of plant maturity on lint yield and quality, 1969¹*

Date of harvest	Lint yield for each harvest (lb/acre)	Accumulative lint yield (lb/acre)	Accumulative percentage of crop	Colorimeter reflectance	+ b	2.5% span length (inch)	Fibrograph uniformity index	Strength, 0-gage (100 lb/in ²)	Micronaire	Neps/100 in ² of web
Sept. 15	136	136	18	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Sept. 22	163	299	39	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Sept. 29	177	476	61	79.7	9.0	1.07	48.0	82.8	5.0	5.2
Oct. 6	117	593	76	80.6	9.1	1.13	47.4	80.8	4.6	6.6
Oct. 14	97	690	88	79.9	8.9	1.13	46.6	81.2	4.3	10.8
Nov. 5	71	781	100	78.3	8.3	1.13	46.4	81.6	4.3	11.2

¹ 1 row from each replicate was picked 6 times, once on each harvest date. Each value is an average of 1 sample from each of 5 replicates.

² Samples from the first 2 harvesting dates were lost before fiber tests could be run.

significantly higher in grade index than the cotton picked during the other periods. There were significant interactions for length uniformity index, staple length, and grade index between the harvesting times and ginning setups.

The cotton picked when all of the bolls were open and ginned under the elaborate setup had significantly shorter fiber than the rest of the cotton. The early-picked, 40-percent-open cotton and the cotton picked when 100 percent of the bolls were open, when ginned under the normal ginning setup, were lower in composite grade than the other cotton.

The most significant factor affecting length and grade was the ginning setup (table 19). Fibrograph length, length uniformity, and staple length under the elaborate ginning setup were lower than or in rare instances remained the same as that of cotton picked at the same time but ginned under the normal setup. Although the interaction between ginning and plant maturity was variable, the trend of this interaction was consistent. Grade index, however, was improved by the use of the elaborate ginning setup.

Colorimeter reflectance and degree of yellowness decreased significantly as the crop remained longer in the field (table 6). The reflectance increased until 75 percent of the bolls were open and then decreased. Fiber strength was decreased by picking either too early or too late while Micronaire values were not affected. Defoliation significantly reduced the degree of yellowness, strength, and Micronaire (table 20).

The elaborate ginning setup significantly decreased foreign matter in the lint and increased the degree of yellowness, but had no effect on colorimeter reflectance and strength (table 21).

The different timings of the harvests significantly affected the foreign-matter content of the wagon sample (table 22). The early-harvested cotton had significantly more leaf trash and sticks and stems and significantly fewer hulls than the cotton harvested when 100-percent open. There were no significant interactions for the foreign-matter content of the various wagon samples. The untreated cotton had significantly more leaf trash and total foreign matter than did the defoliated cotton (table 23). The early-harvested cotton was significantly higher in leaf and sticks and stems content and total foreign matter at the feeder apron than cotton harvested at other times. There were no significant inter-

(Continued on page 16.)

TABLE 14.—*Effects of different stages of plant maturity, defoliation, and ginning setup on cottonseed quality in first-over harvests, 1969¹*

Date of 1st harvest and defoliated (D) or untreated (U)	Ginning setup ²	Moisture (pct)	Germination (pct)	Cracked seeds (pct)	Light seeds (pct)
Sept. 15,					
40-pct open:					
D	Normal	11.9	72.4	24.6	5.0
U	... do	24.9	46.4	36.0	3.4
D	Elaborate	12.8	66.6	28.2	4.0
U	... do	28.6	57.8	31.4	3.4
Sept. 22,					
60-pct open:					
D	Normal	12.3	78.2	21.4	2.2
U	... do	13.4	74.4	22.2	3.4
D	Elaborate	12.8	80.0	19.4	4.2
U	... do	15.6	80.6	17.0	4.4
Sept. 29,					
75-pct open:					
D	Normal	8.4	79.0	18.0	3.2
U	... do	14.0	82.8	14.8	3.6
D	Elaborate	8.3	81.2	20.8	3.2
U	... do	14.3	81.6	16.4	2.8
Oct. 6,					
90-pct open:					
D	Normal	9.2	85.6	13.6	4.4
U	... do	10.5	84.0	17.4	3.6
D	Elaborate	8.7	85.0	16.4	4.4
U	... do	10.5	88.0	17.8	4.8
Oct. 14,					
95-pct open:					
D	Normal	11.2	93.4	17.4	3.4
U	... do	13.2	95.0	18.4	4.2
D	Elaborate	11.6	91.0	17.0	5.0
U	... do	13.1	90.0	13.4	3.8
Nov. 5,					
100-pct open:					
D	Normal	8.9	94.4	17.2	4.2
U	... do	9.2	95.8	17.8	3.6
D	Elaborate	8.0	95.0	20.6	4.8
U	... do	9.6	95.6	18.2	4.2

¹ Values are averaged over 5 samples, 1 from each of 5 replicates.

² Normal setup: drier, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners.
Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

TABLE 15.—*Effects of different stages of plant maturity, defoliation, and ginning setups on cottonseed quality in second harvests, 1969¹*

Date of 1st harvest and de- foliated (D) or untreated (U)	Ginning setup ²	Moisture (pct)	Germination (pct)	Cracked seeds (pct)	Light seeds (pct)
Sept. 15:					
D	Normal	8.7	95.8	20.2	16.8
U	... do	8.8	94.0	19.2	16.0

See footnotes at end of table.

TABLE 15.—*Effects of different stages of plant maturity, defoliation, and ginning setups on cottonseed quality in second harvests, 1969—Continued*

Date of 1st harvest and de- foliated (D) or untreated (U)	Ginning setup ²	Moisture (pct)	Germination (pct)	Cracked seeds (pct)	Light seeds (pct)
Sept. 15—Continued:					
D	Elaborate	8.9	95.8	16.6	12.6
U	... do	9.4	95.6	19.6	14.0
Sept. 22:					
D	Normal	8.6	96.2	17.6	7.4
U	... do	9.2	96.0	18.0	6.0
D	Elaborate	10.0	95.6	20.0	8.0
U	... do	10.6	95.0	16.6	5.8
Sept. 29:					
D	Normal	9.3	90.8	16.4	10.2
U	... do	8.7	96.4	14.6	4.4
D	Elaborate	8.7	96.2	18.6	11.8
U	... do	10.5	96.0	14.6	7.6
Oct. 6:					
D	Normal	9.2	97.0	14.4	7.6
U	... do	8.6	96.4	14.2	7.0
D	Elaborate	8.6	95.4	17.0	6.0
U	... do	8.4	95.6	16.0	6.4
Oct. 14:					
D	Normal	8.3	95.6	15.0	7.8
U	... do	9.1	95.6	14.0	7.0
D	Elaborate	9.0	95.6	15.8	6.6
U	... do	10.4	93.8	20.8	7.6

¹ Values are averaged over 5 samples, 1 from each of 5 replicates.

² Normal setup: drier, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

TABLE 16.—*Weather preceding harvest, 1970*

Weather parameters	Aug. 17– Sept. 21	Sept. 22– Sept. 28	Sept. 29– Oct. 5	Oct. 6– Nov. 5	Nov. 6– Nov. 16 ¹	Nov. 6– Nov. 24
Days	36	7	7	31	11	19
Total rainfall in ...	3.20	0.91	0.00	7.86	2.48	2.78
Growing degree days base 60° F ...	7,405	980	690	800	3	3
Accumulative degree days base 60° F ...	7,405	8,385	9,075	9,875	9,878	9,878
8-hour periods of 95-pct relative humidity	68	14	5	50	13	18
Solar radiation langleys ...	17,118	2,206	3,346	9,728	3,114	5,692
Energy degree units ² × 10 ⁻⁴	12,675	216	231	778	1	2
Hours < 60° F	0	32	46	384	219	359

¹ Killing frost and freeze occurred Nov. 16.

² Energy degree units = (Mean temperature minus the base temperature) times the daily accumulation of solar radiation in langleys per day.

TABLE 17.—*Cotton moisture data, 1970*¹

Date of 1st harvest ² and defoliated (D) or untreated (U)	Ginning setup ³	Percentage of moisture in—							
		Wagon sample		Feeder sample		Lint		Seed	
		1st picking	2d picking	1st picking	2d picking	1st picking	2d picking	1st picking	2d picking
Sept. 21, 40-pct open:									
D	Normal	10.5	9.9	9.9	9.7	6.8	8.1	10.6	10.1
D	Elaborate	11.2	9.4	10.7	9.3	7.1	7.4	12.5	11.5
U	Normal	14.7	9.5	11.6	9.6	8.1	7.6	12.6	10.4
U	Elaborate	13.1	9.9	10.9	9.8	6.3	6.9	13.6	10.9
Sept. 28, 60-pct open:									
D	Normal	10.7	9.9	9.8	9.8	6.1	6.6	10.9	11.9
D	Elaborate	9.9	9.8	8.2	8.9	5.0	6.6	10.1	10.8
U	Normal	11.5	9.7	7.0	9.6	5.5	6.4	12.2	10.5
U	Elaborate	11.9	9.5	10.2	6.0	4.8	6.6	12.2	9.9
Oct. 5, 75-pct open:									
D	Normal	7.3	9.5	7.7	8.5	6.4	6.9	7.3	11.3
D	Elaborate	7.7	9.8	7.5	9.0	5.7	6.7	8.4	11.4
U	Normal	8.5	10.1	8.0	8.7	6.1	7.0	8.4	11.0
U	Elaborate	10.2	11.1	8.1	9.5	5.9	7.0	8.9	11.2
Nov. 5, 100-pct open:									
D	Normal	10.3	...	9.1	...	6.3	...	10.5	...
D	Elaborate	10.1	...	8.4	...	5.0	...	10.3	...
U	Normal	12.2	...	9.4	...	5.9	...	11.5	...
U	Elaborate	12.1	...	9.0	...	4.6	...	10.9	...

¹ Values are averaged over 5 samples, 1 from each of 5 replicates.

² Second picking was done when the remaining cotton was 100-percent open.

³ Normal setup: drier, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

TABLE 18.—*Effects of different stages of plant maturing on lint yields and dollar returns, 1970*¹

Date of 1st harvest	Open bolls (pct)	Lint yield, 1st picking (lb/acre)	Total lint yield (lb/acre)	Gross return (dol/acre)	Return above operating costs ² (dol/acre)
Sept. 21	40	708	991a	228.79a	212.01a
Sept. 28	60	749	997a	234.87a	218.05a
Oct. 5	75	836	1045a	250.82a	234.04a
Nov. 5	100	1008	1008a	232.11a	222.09a

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² Include costs of defoliation and harvesting.

actions among harvest dates for the foreign-matter content of the samples collected at the feeder apron.

Leaf content, which was significantly higher

in untreated cotton, was the only foreign-matter component that varied significantly between defoliated and untreated cotton when measured at the feeder apron (table 24). The elaborate

ginning setup significantly reduced the total foreign matter measured at the feeder apron to 1.86 percent, as compared with 1.64 percent for the normal setup, and reduced the amount of sticks and stems at the feeder apron to 0.27 percent as compared with 0.34 for the normal setup. The other trash components were not affected by ginning setup.

The plant maturity at time of harvest significantly affected visible seed damage and the foreign-matter content of the lint, but it had no effect on nep count or harvesting efficiency (table 24). The early-harvested cotton had significantly higher foreign matter in the lint. The cotton harvested when all bolls were open was

TABLE 19.—*Effects of ginning setup on fiber length and grade, 1970¹*

Ginning setup ²	Fibro-graph length (inch)	Length uniformity index (pct)	Staple length (32ds of an inch)	Grade ³
Normal	1.15a	44.9a	34.9a	96.1a
Elaborate . .	1.14b	44.0b	34.7b	98.3a

¹ Values were obtained by using weighted averages from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 8 samples from each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95-percent level according to the *F*-test.

² Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

³ 100=Middling; 94=Strict Low Middling; 90=Low Middling Plus.

TABLE 20.—*Effects of defoliation on fiber quality, 1970¹*

Defoliated or untreated	Colorimeter reflectance	+ b	Strength, 0-gage (1,000 lb/inch ²)	Micro-naire
Defoliated	76.3a	8.06a	80.6b	4.11b
Untreated	75.8a	8.24b	81.4a	4.19a

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation, using 8 samples from each of 5 replicates. Values in the same columns followed by different letters are significantly different at the 95-percent level according to the *F*-test.

TABLE 21.—*Effects of ginning setup on fiber quality and lint foreign matter, 1970¹*

Ginning setup ²	Colorimeter reflectance	Strength, 0-gage (1,000 lb/in ²)	Lint foreign matter (pct)	+ b
Normal	75.8a	81.0a	2.66a	8.07a
Elaborate	76.3a	81.0a	1.82b	8.23b

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 8 samples from each of 5 replicates. Values in the same column followed by different letters are significantly different at the 95-percent level according to the *F*-test.

² Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

lowest in visible seed damage, probably because more mature seed was harvested at this time.

The nep count and the foreign-matter content of the lint were significantly affected by ginning. The elaborate ginning setup resulted in a lint foreign-matter content of 1.82 percent and a nep count of 32.1, compared with 2.66-percent lint foreign-matter content and a nep count of 24.7 with the normal ginning setup. Neither defoliation nor ginning had a significant effect on visible cottonseed damage.

The harvesting efficiency for the untreated cotton was 96.8 percent, significantly higher than the defoliated cotton's 96.3 percent. This was probably a result of significantly higher yields for the untreated cotton over the defoliated cotton.

One row from each replicate was hand picked on each harvest date, for a total of five harvests on each row. The yield and fiber data for cotton from these rows are shown in table 25. The earlier cotton showed tendencies toward higher Micronaire, greater length, and lower strength.

CONCLUSIONS, 1970

Excessive rains during October prevented any machine harvesting during this period. Thus, the cotton was harvested in the early and the very late parts of the season.

There were no significant differences in yield, gross returns, or returns above operating costs (Continued on page 21.)

TABLE 22.—*Effects of different stages of plant maturity on wagon- and feeder-sample foreign matter, 1970¹*

Date of 1st harvest	Open bolls (pct)	Foreign matter (pct)					Total
		Hulls	Sticks and stems	Leaf ²	Motes	Pin trash	
Wagon-sample foreign matter:							
Sept. 21	40	1.8c	0.7a	4.3a	0.2a	0.4a	7.4a
Sept. 28	60	2.3b	.5ab	3.0bc	.2a	.3a	6.3a
Oct. 5	75	2.3b	.6a	3.6ab	.2a	.3a	7.0a
Nov. 5	100	2.7a	.4b	2.7c	.2a	.3a	6.3a
Feeder-sample foreign matter:							
Sept. 21	40	.7a	.5a	1.0a	.1a	.1a	2.4a
Sept. 28	60	.6a	.3b	.5b	.1a	.1a	1.6b
Oct. 5	75	.6a	.2c	.5b	.1a	.1a	1.5b
Nov. 5	100	.6a	.2c	.5b	.1a	.1a	1.5b

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 2 samples from each of 5 replicates. Values for feeder samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of ginning setup, level of maturity, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replicates. Values in the same column and from the same group of samples followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

TABLE 23.—*Effects of defoliation on foreign matter in wagon and feeder-apron samples, 1970¹*

[Percent]

Defoliated or untreated	Hulls	Sticks and stems	Leaf ²	Motes	Pin trash	Total
Wagon-sample foreign matter:						
Defoliated	2.3a	0.5a	2.9a	0.2a	0.3a	6.2a
Untreated	2.2a	.6a	3.8b	.2a	.3a	7.1b
Feeder-apron sample foreign matter:						
Defoliated	.6a	.3a	.6b	.1a	.1a	1.7a
Untreated	.6a	.3a	.7a	.1a	.1a	1.8a

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity and defoliation, using 4 samples from each of 5 replicates. Values for feeder-apron samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation, using 8 samples from each of 5 replicates. Values in the same column from the same group of samples followed by the same letter are not significantly different at the 95-percent level according to the *F*-test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

TABLE 24.—*Effects of different stages of plant maturity on lint foreign matter, visible seed damage, nep counts, and harvesting efficiency of overall harvest, 1970¹*

Date of 1st harvest	Open bolls (pct)	Visible seed damage (pct)	Lint foreign matter (pct)	Neps/ 100 inch ² of web	Harvesting efficiency (pct)
Sept. 21	40	37.8ab	2.7a	29.2a	96.7a
Sept. 28	60	39.3a	2.1b	27.9a	96.7a
Oct. 5	75	35.0bc	2.0b	27.1a	96.6a
Nov. 5	100	31.9c	2.1b	29.5a	96.3a

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replicates for all data except that for harvesting efficiency, which used 2 samples from each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

TABLE 25.—*Effects of handpicking cotton at different stages of plant maturity on lint yields and fiber quality, 1970¹*

Date of harvest	Lint yield for each harvest (lb/ acre)	Accumulative lint yield (lb/acre)	Accumulative percentage of crop	50% span length (inch)	2.5% span length (inch)	Elongation (pct)	Strength, 0-gage (g/tex)	Micro- naire
Sept. 21	705	705	61.6	0.54	1.15	8.2	19.51	4.6
Sept. 28	167	872	76.2	.54	1.18	8.0	19.32	4.1
Oct. 5	121	993	86.7	.55	1.17	8.4	20.70	3.6
Nov. 5	151	1145	100.0	.49	1.11	7.9	20.36	3.7

¹ 1 row from each of 5 replicates was picked 4 times, once on each harvest date. Each value is an average of 1 sample from each of 5 replicates.

TABLE 26.—*Cotton moisture data, 1971¹*

Date of 1st harvest and defoliated (D) or untreated (U)	Ginning setup	Percentage of moisture in—							
		Wagon sample		Feeder sample		Lint		Seed	
		1st picking	2d picking	1st picking	2d picking	1st picking	2d picking	1st picking	2d picking
Sept. 28, 76-pct open :									
D	Normal	11.4	7.5	10.3	6.5	7.9	5.1	13.2	7.6
D	Elaborate	12.8	7.3	10.9	7.0	6.2	4.8	14.0	8.8
U	Normal	11.6	7.9	10.1	6.5	6.9	4.8	12.9	8.1
U	Elaborate	11.9	8.1	9.9	6.6	5.9	4.5	14.3	9.1
Oct. 5, 87-pct open :									
D	Normal	8.0	8.6	8.2	7.4	6.4	4.6	10.6	9.5
D	Elaborate	8.9	7.8	8.4	7.4	5.8	4.4	9.3	8.9

See footnotes at end of table.

TABLE 26.—Cotton moisture data, 1971¹—Continued

Date of 1st harvest and defoliated (D) or untreated (U)	Ginning setup	Percentage of moisture in—							
		Wagon sample		Feeder sample		Lint		Seed	
		1st picking	2d picking	1st picking	2d picking	1st picking	2d picking	1st picking	2d picking
87-pct open—Continued:									
U	Normal	9.9	7.5	8.9	7.2	6.2	4.5	11.4	8.8
U	Elaborate	9.5	8.3	9.6	5.3	5.9	4.5	10.9	8.8
Oct. 12, 92-pct open:									
D	Normal	6.5	8.7	6.3	5.9	4.7	4.6	9.3	8.8
D	Elaborate	7.0	8.6	6.5	7.0	4.9	4.4	7.9	7.9
U	Normal	7.0	7.6	7.5	7.2	5.0	4.8	8.8	8.6
U	Elaborate	7.2	8.8	7.1	6.3	4.7	4.1	8.5	8.2
Oct. 19, 95-pct open:									
D	Normal	10.4	8.5	9.8	6.6	6.2	4.4	13.2	8.2
D	Elaborate	10.4	7.9	8.9	7.6	5.6	4.2	12.9	9.3
U	Normal	12.9	8.4	10.6	7.6	5.8	4.3	14.5	9.8
U	Elaborate	11.6	7.8	10.1	6.9	5.2	4.3	14.3	10.0
Oct. 26, 98-pct open:									
D	Normal	7.3	7.9	8.3	7.4	5.9	4.2	10.5	9.5
D	Elaborate	8.8	9.2	7.8	7.3	5.4	4.3	9.6	9.4
U	Normal	8.6	8.9	8.3	8.1	5.7	4.2	11.5	9.3
U	Elaborate	9.9	11.2	9.1	7.4	5.3	4.1	9.5	9.2
Nov. 8, 100-pct open:									
D	Normal	7.1	...	7.4	...	4.8	...	9.5	...
D	Elaborate	6.7	...	7.0	...	4.7	...	8.7	...
U	Normal	8.3	...	7.7	...	4.9	...	9.6	...
U	Elaborate	8.2	...	6.9	...	4.6	...	9.4	...

¹ Values were averaged over 5 samples, 1 from each of 5 replicates.² Second picking was done when the remaining cotton was 100-percent-open.³ Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.TABLE 27.—Weather preceding harvest, 1971¹

Weather parameters	Aug. 8— Sept. 28	Sept. 29— Oct. 5	Oct. 6— Oct. 12	Oct. 13— Oct. 19	Oct. 20— Oct. 26	Oct. 27— Nov. 8
Days	39	7	7	7	7	12
Total rainfall	inches ... 2.53	0.20	0.21	Trace	0.08	0.11
Growing degree days	base 60° F ... 689.0	114.5	42.0	79.0	50.5	82.0
Accumulative degree days	base 60° F ... 689.0	803.5	845.5	924.5	975.0	1,057.0
8-hour periods of >95-percent						
relative humidity	47	12	5	8	10	8
Solar radiation	langleys ... 15,838	2,476	2,860	2,059	1,837	4,524
Energy degree units ¹ × 10 ⁻⁴	1,091.2	28.4	12.0	16.3	9.3	37.1
Hours < 60° F	20	0	57	23	38	128

¹ Energy degree units = (Mean temperature minus the base temperature) times the daily accumulation of solar radiation in langleys per day.

among all four harvests, although the cotton which was harvested when 80 percent of the bolls were open produced best and gave the best returns. The untreated cotton gave significantly better yields and monetary returns than did the defoliated portion of the crop.

Colorimeter reflectance and degree of yellowness decreased significantly with increased exposure in the field. Fiber strength was reduced by picking too early and too late. Defoliation reduced degree of yellowness, strength, Micronaire, and trash content. The elaborate ginning setup decreased foreign-matter content and increased grade but tended to reduce fibrograph length. The trash content of the samples decreased as the harvests grew later.

EXPERIMENT AND RESULTS, 1971

In 1971, the first pickings in test plots were made on September 28, October 5, October 12, October 19, October 26, and November 8. All bolls were open in the November 8 picking, and all other plots were second-picked at that time. Figure 5 shows the boll-opening curve for the 'DPL 16' cotton grown.

Rain during the early part of September prevented harvesting when 40 percent of the bolls were open as originally planned. The first harvest occurred on September 28 when 76 percent of the cotton was open. The wagon-sample moisture ranged from 11.9 percent for the cotton harvested on September 28 to 9.9 percent for the cotton harvested when 87 percent of the bolls were open on October 5 (table 26).

The weather was favorable throughout most of the test period (table 27), and after harvesting began, no scheduled harvest was postponed because of rain. Relative humidity and temperature both decreased as the season progressed. There was a marked decline in growing degree days after October 6. Yields were slightly lower than expected because of extended dry periods during the growing season, even though the cotton was irrigated once.

There was a significant three-way interaction between harvest date, defoliation, and ginning setup and the total yield, gross returns, and returns above operating costs in 1971 (table 28). The harvests made when the cotton was 85- to 98-percent open tended to be superior to the others in lint yield, gross returns, and returns

above operating costs. The untreated cotton tended to be better than the defoliated in total lint yield, gross returns, and returns above costs (table 4). The once-over harvest left more cotton in the field than all of the twice-over harvests except that in which the first picking occurred on October 12 (fig. 6).

The effects of harvest timing on total lint yield, visible seed damage, and nep count are shown in table 29. The nep count decreased as the season progressed.

Significant differences occurred among different harvesting dates for fibrograph length, length uniformity index, staple length, and grade (table 6). Fibrograph length, staple length, and length uniformity index decreased with the later harvesting dates. The grade increased with maturity and exposure. There were no significant interactions among treatments for length, length uniformity, staple length, or grade.

Defoliation significantly affected colorimeter reflectance, $+b$ (degree of yellowness), and

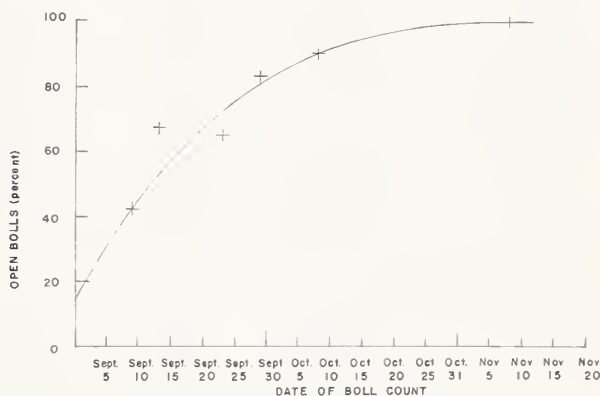


FIGURE 5.—Boll-opening curve for 'DPL 16' cotton, 1971.

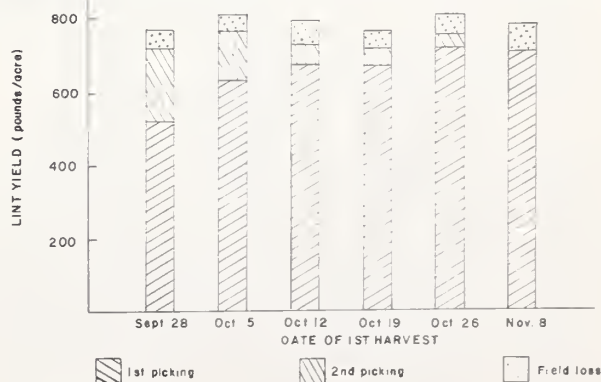


FIGURE 6.—Relationship between date of first harvest, yields, and harvest losses, 1971.

TABLE 28.—*Effects of different stages of plant maturity, defoliation, and ginning setup on lint yields and dollar returns, 1971¹*

Date of 1st harvest and defoliated (D) or untreated (U)	Ginning setup ²	Lint yield, 1st picking (lb/acre)	Total lint yield (lb/acre)	Gross return (dol/acre)	Return above operating costs ³ (dol/acre)
Sept. 28,					
76-pct open:					
D	Normal	524	705efghi	149.08fg	131.33hi
D	Elaborate	507	688ghi	147.22g	129.22i
U	Normal	506	747cde	164.46bcde	148.64bcdefg
U	Elaborate	510	756bcd	170.53bcd	154.46bcde
Oct. 5,					
87-pct open:					
D	Normal	660	773abc	168.73bcd	150.98bcdefg
D	Elaborate	643	756bcd	169.75bcd	151.75bcdefg
U	Normal	633	795ab	176.99ab	161.17ab
U	Elaborate	598	760bcd	170.73bc	154.66bcde
Oct. 12,					
92-pct open:					
D	Normal	698	756bcd	170.24bc	152.49bcdef
D	Elaborate	686	743cdef	164.21cde	146.21cdefg
U	Normal	663	726cdefg	163.67cde	147.85bcdefg
U	Elaborate	644	706efghi	156.75defg	140.68efghi
Oct. 19,					
95-pct open:					
D	Normal	716	759bcd	168.96bcd	151.21bcdefg
D	Elaborate	658	697fghi	156.94defg	138.94fghi
U	Normal	655	718defgh	157.08defg	141.26efghi
U	Elaborate	642	717defgh	160.47cdef	144.40efgh
Oct. 26,					
98-pct open:					
D	Normal	676	730cdefg	162.14cde	144.39efgh
D	Elaborate	710	764bcd	170.48bc	152.48bcdef
U	Normal	776	813a	184.76a	168.94a
U	Elaborate	700	735cdefg	161.35cdef	145.38defg
Nov. 8,					
100-pct open:					
D	Normal	677	677hi	153.31efg	142.32efghi
D	Elaborate	666	666i	149.27fg	138.03ghi
U	Normal	751	751bcde	169.32bcd	160.25abc
U	Elaborate	744	744cdef	168.41bcd	159.10abcd

¹ Values are averaged over 5 samples, 1 from each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95 percent level according to Duncan's new multiple-range test.

² Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

³ Include costs of defoliation and harvesting.

strength (table 30). The elaborate ginning setup resulted in significantly higher colorimeter reflectance and composite grade. It significantly decreased lint foreign matter and fiber strength when compared with the normal ginning setup (table 31). The additional mechanical action associated with the elaborate ginning setup significantly reduced fibrograph length, length uniformity index, and staple length and in-

creased the nep count of the ginned lint (table 32).

The additional exposure time allowed by once-over harvesting significantly improved colorimeter reflectance and the degree of yellowness but reduced fiber strength (table 6).

Harvest timing had no significant effect on foreign matter measured in the wagon or at the feeder apron (table 33). Defoliation significantly reduced the amount of sticks and stems, leaf,

TABLE 29.—*Effects of different stages of plant maturity on lint yields, visible seed damage, and nep counts, 1971¹*

Date of 1st harvest	Open bolls (pct)	Lint yield, 1st picking (lb/acre)	Total lint yield (lb/acre)	Visible seed damage (pct)	Neps/ 100 inch ² of web
Sept. 28	76	511	724a	23.7abc	27.8a
Oct. 5	87	633	771a	27.0ab	27.6a
Oct. 12	92	673	733a	25.8abc	27.7a
Oct. 19	95	668	723a	21.3c	21.7b
Oct. 26	98	716	760a	22.5bc	22.6b
Nov. 8	100	710	710a	28.5a	17.6c

¹ Values are averaged over both defoliated and untreated cotton and both ginning setups, using 4 samples from each of 5 replicates. Values in the same column followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

TABLE 30.—*Effects of defoliation on fiber color and strength, 1971¹*

Defoliated or untreated	Colorimeter reflectance	+ b	Strength, 0-gage (1,000 lb/inch ²)
Defoliated	76.4	7.69	80.3
Untreated	76.4	7.81	79.8

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation, using 12 samples from each of 5 replicates. Values in the same column, except for colorimeter reflectance, are significantly different at the 95-percent level according to the *F*-test.

and total foreign matter content in the wagon sample (table 34). However, defoliation had no effect on foreign matter measured at the feeder apron. The interaction between defoliation and

date of harvest with respect to foreign-matter content is shown in table 35. Handpicked plots were used in 1971 to determine plant maturity and the amount of fiber developing within a specific period (table 36).

CONCLUSIONS, 1971

Highest yields and highest returns above preparation and harvesting costs resulted from the untreated cotton picked when approximately 98 percent of the bolls were open and processed through a normal ginning setup. As a general rule, the cotton left untreated and picked late in the year performed better than other cotton.

The elaborate ginning setup, with its additional impact cleaner and lint cleaner, improved grade but reduced fiber strength and trash content of the lint. Defoliation tended to increase grades but reduced yield enough to make it more profitable to leave the crop untreated.

TABLE 31.—*Effects of ginning setup on fiber quality and lint foreign matter, 1971¹*

Ginning setup ²	Colorimeter reflectance	+ b	Strength, 0-gage (1,000lb/ inch ²)	Lint foreign matter (pct)	Composite grade ³
Elaborate	76.6	7.77	79.6	1.68	98.9
Normal	76.3	7.73	80.4	1.94	97.9

¹ Values were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, using 12 samples from each of 5 replicates. Values in the same column are significantly different at the 95-percent level according to the *F*-test.

² Normal setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

³ 100 = Middling; 94 = Strict Low Middling.

TABLE 32.—*Effects of ginning setup on fiber length and nep counts, 1971¹*

Ginning setup ²	2.5% span length (in)	Length uniformity index (pct)	Staple length (32ds of an inch)	Neps/100 inch ² of web
Normal	1.15	44.2	34.8	21.4
Elaborate ...	1.14	43.7	34.6	26.9

¹ Values are averaged over all harvests and both defoliated and untreated cotton, using 12 samples from each of 5 replicates. Values in the same column are significantly different at the 95-percent level according to the *F*-test.

² Normal setup: drier, 6-cylinder cleaners, stick remover, 6-cylinder cleaner, extractor-feeder-cleaner, and 2 lint cleaners. Elaborate setup: drier, 6-cylinder cleaner, stick remover, 6-cylinder cleaner, impact cleaner, extractor-feeder-cleaner, and 3 lint cleaners.

CONCLUSIONS

The 3-year study showed that maximum yields tended to result from twice-over harvesting of undefoliated cotton whose first-over harvest occurred when approximately 85 percent of the bolls were open (fig. 7). The extra cleaning from the elaborate ginning setup gave higher grade and less lint foreign matter but tended to reduce fiber strength and length and created more neps in the ginned lint. Defoliation significantly increased composite grade and reflectance each year, but the decrease in yield resulting from defoliation and the cost of the treatment itself offset the gains in grade.

Maximum gross and net returns tended to occur with a twice-over harvest, the first harvest having occurred when the cotton was 80- to

TABLE 33.—*Effects of different stages of plant maturity on wagon- and feeder-sample foreign matter, 1971¹*

Date of 1st harvest	Open bolls (pct)	Foreign matter (pct)				Motes	Total
		Hulls	Sticks and stems	Leaf ²	Pin trash		
Wagon-sample foreign matter:							
Sept. 28	76	1.3	0.6	2.0	0.1	0.3	4.3
Oct. 5	87	1.3	.7	2.2	.2	.4	4.8
Oct. 12	92	1.6	.6	2.0	.1	.4	4.7
Oct. 19	95	1.3	.6	1.9	.1	.4	4.3
Oct. 26	98	1.5	.6	2.0	.1	.4	4.6
Nov. 8	100	1.3	.8	2.1	.2	.4	4.8
Feeder-sample foreign matter:							
Sept. 28	76	.7	.4	.4	.0	.2	1.7
Oct. 5	87	.9	.3	.4	.0	.3	1.9
Oct. 12	92	.8	.3	.4	.0	.3	1.8
Oct. 19	95	.8	.4	.4	.0	.3	1.9
Oct. 26	98	.7	.3	.4	.0	.3	1.7
Nov. 8	100	.7	.4	.4	.0	.3	1.8

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d harvests for each combination of level of maturity and defoliation. These values were then averaged over defoliated and untreated cotton, using 22 samples from each of 5 replicates. Values for feeder samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation. These values were then averaged over defoliated and untreated cotton, thereby using 4 samples from each of 5 replicates. Values in the same column and from the same group of samples are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

TABLE 34.—*Effects of defoliation on foreign matter in wagon and feeder-apron samples, 1971¹*

[Percent]						
Defoliated of untreated	Hulls	Sticks and stems	Leaf ²	Pin trash	Motes	Total
Wagon-sample foreign matter:						
Defoliated	1.5a	0.6b	1.7b	0.1a	0.4a	4.3b
Untreated	1.3a	.7a	2.3a	.1a	.4a	4.8a
Feeder-apron sample foreign matter:						
Defoliated	.8a	.3a	.4a	.0a	.3a	1.8a
Untreated	.7a	.4a	.4a	.0a	.3a	1.8a

¹ Values for wagon samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity and defoliation, using 6 samples from each of 5 replicates. Values for feeder-apron samples were obtained by using a weighted average from both 1st and 2d pickings for each combination of level of maturity, ginning setup, and defoliation, using 12 samples from each of 5 replicates. Values in the same column and from the same group of samples followed by the same letter are not significantly different according to the *F*-test.

² In 1969, but not in 1970 or 1971, leaf content was broken down into large- and small-leaf divisions.

TABLE 35.—*Interaction of defoliation and plant maturity on lint foreign matter, 1971¹*

[Percent]						
Defoliated or Untreated	Foreign matter in cotton first picked on—					
	Sept. 28	Oct. 5	Oct. 12	Oct. 19	Oct. 26	Nov. 8
Defoliated	1.94a	1.75ab	1.52b	2.11a	1.70ab	1.78ab
Untreated	2.14a	1.96a	1.52b	1.97a	1.77ab	1.51b

¹ Values were obtained by using a weighted average from both 1st and 2d pickings, for each combination of level of maturity, ginning setup, and defoliation, using 2 samples from each of 5 replicates. Values followed by the same letter are not significantly different at the 95-percent level according to Duncan's new multiple-range test.

TABLE 36.—*Effects of handpicking cotton at different stages of plant maturity on lint yield, 1971¹*

Date of harvest	Lint yield for each harvest (lb/acre)	Accumulative lint yield (lb/acre)	Accumulative percentage of crop
Sept. 27	559	559	81
Oct. 4	55	614	89
Oct. 12	48	662	96
Oct. 19	11	673	98
Oct. 26	8	681	99
Nov. 8	6	687	100

¹ 1 row from each replicate was picked 6 times, once on each harvest date. Each value is an average of 1 sample from each of 5 replicates. No data on quality were obtained for handpicked cotton in 1971.

90-percent open (figs. 8 and 9). Harvest and defoliation costs tended to flatten the curve.

The boll count method of determining the stage of plant maturity proved to be inaccurate when the values obtained by this method were compared to the actual ratio of the yield of cotton harvested during first pick to the total yield of cotton. This is a result of the variability among the bolls themselves, and the fact that some bolls may never get a chance to open. However, the boll count method remains the farmer's best guide to the maturity of a crop while it is still in the field.

Delaying harvest until approximately all of the cotton was open tended to reduce fiber strength, trash content, seed damage, and fiber length. Reflectance decreased with delayed harvest in 1969 and 1970 but increased in 1971.

Micronaire was not affected by differences in harvest timing except in the first harvest in 1969. The very low Micronaire reading for that harvest indicated immaturity of the fiber.

Other studies conducted at Stoneville support the conclusions drawn from this study that twice-over harvesting in which first harvest occurs after 75 percent of the cotton is open will probably give maximum yield and gross and net returns on a farm basis. Since the costs of defoliation and the reduction in yield caused by it offset the improvements in grade it can pro-

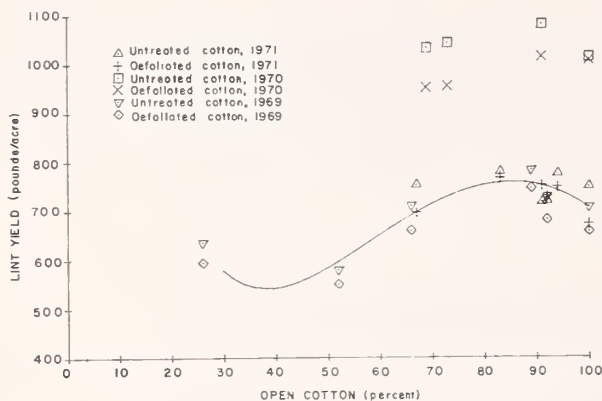


FIGURE 7.—Effects of different stages of plant maturity on total yields. The regression line reflects 1969 untreated cotton. The other defoliated and untreated cotton would have similar lines, shifting only for year and preparation. Percentage of open cotton is ratio of cotton picked during first harvest to total cotton harvested.

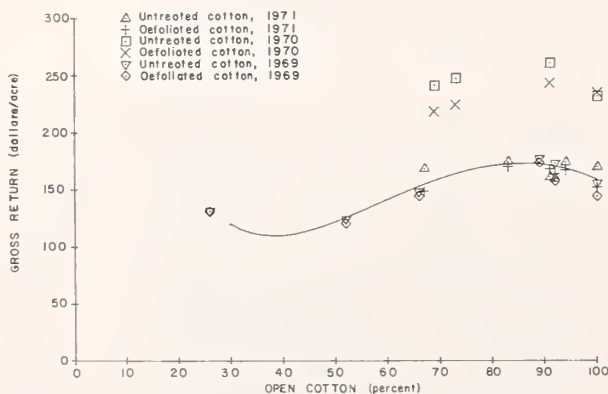


FIGURE 8.—Effects of different stages of plant maturity on gross returns per acre. The regression line reflects 1969 untreated cotton. The other defoliated and untreated cotton would have similar lines, shifting only for year and preparation. Economic values were determined by use of the loan values for cotton. Percentage of open cotton is ratio of cotton picked during first harvest to total cotton harvested.

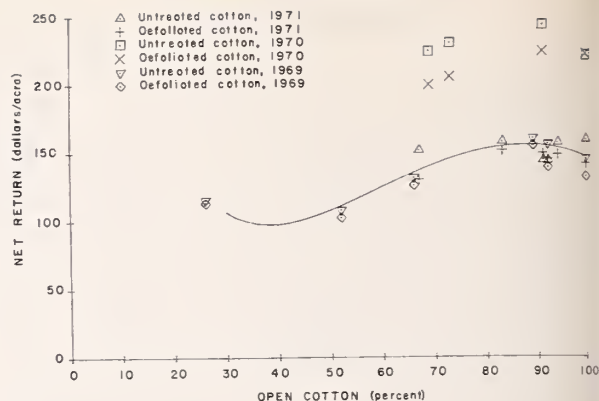


FIGURE 9.—Effects of different stages of plant maturity on net returns above preparation costs. The regression line reflects 1969 untreated cotton. The other defoliated and untreated cotton would have similar lines, shifting only for year and preparation. Percentage of open cotton is ratio of cotton picked during first harvest to total cotton harvested.

duce, defoliants need not be applied if many of the leaves have fallen naturally and second growth is not prevalent. However, as pointed out by Riley and Williamson (10), defoliation does allow the cotton picker to pick about an hour longer each day. The elaborate ginning setup with extra overhead and extra lint-cleaning machinery reduces fiber weight and does not improve the cotton fiber enough to offset the cost of installation and the loss in fiber weight.

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